



# *Arizona*

## *Measure of Academic Progress*

*A First Look at Growth in Arizona Schools*  
*Technical Document*

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## **Introduction**

The Arizona Measure of Academic Progress (MAP) has been developed to examine the academic growth of individual students over time. Although inspired by the Tennessee Value Added Assessment System (TVAAS) and the work of Dr. William Sanders of the University of Tennessee Knoxville, the Arizona model does not mirror Tennessee but is the first step in documenting growth in Arizona schools. The basic idea is to measure academic achievement in terms of growth over time in contrast to absolute scores at one point in time. Although students arrive at school at different levels of preparedness, MAP allows us to measure the amount of growth made by students, regardless of where they start out.

A model for looking at growth on a large scale requires two essential tools. First, the model requires a test that is given to adjoining grades and is linked across grade levels on the same scale. The adoption of the Stanford Achievement Test (Ninth Edition) in 1997, which was to be given to all grades 3 –12, brought the idea of measuring growth one step closer to fruition.

Second, the model requires the linking of individual student test scores across years and grade levels. In the fall of 1998, the Research & Policy Division of the Arizona Department of Education completed the task of linking student test scores across years.

## **Matching Methodology**

In lieu of an individual student identification number, all student matches were conducted based on 21 combinations of the following four variables: (1) last name, (2) first name, (3) date of birth (DOB), (4) gender. In 84% of all matched cases, the last name, first name, DOB and gender matched perfectly. The methodology for matching the remaining 16% of cases involved matching individual letters in either the student's last name or first name. For example,

<u>Year</u>	<u>Last Name</u>	<u>First Name</u>	<u>DOB</u>	<u>G</u>
97	S M I T H	J O H N	12 16 87	M
98	S M I T H	J O H N A T H O N	12 16 87	M
97	M I L L S	E L I Z A B E T H	12 14 87	F
98	M I L L S	B E T H	12 14 87	F

All cases that met the following conditions were considered a match:

- First or last name match perfectly AND
- Enough letters in the student's other name match AND
- DOB match perfectly
- Gender match perfectly

In cases such as the following example, students were matched based on one of the following criteria:

- The records indicate the student was in the same school district for both test administrations
- Sight check

<u>Year</u>	<u>Last Name</u>	<u>First Name</u>	<u>DOB</u>	<u>G</u>	<u>SD</u>
97	J O N E S	M A R T I N	10 18 87	M	Y
98	J O N E S	R A M B O	10 18 87	M	Y

In approximately 5% of all cases, students mislabeled their birth date. These students were matched if they met the following conditions:

- Last name, first name and gender match  
AND
- The student took the test in the same school district  
AND
- The student's birth date is off by only one year OR
- The student's birth date is off by only one day

### **Student Inclusion Criteria**

After all possible student matches were complete from Spring 1998 to Spring 1999, only those students who met all of the following criteria were included in the MAP analysis:

1. The student took the SAT9 in the same school in Spring 1998 and Spring 1999.
2. The student DID NOT take the SAT9 with accommodations in either year.
3. The student DID NOT retake the same level exam in Spring 1998 and Spring 1999.
4. The student has a valid score in a subject area for both years.

Across the state, 89% of all eligible students in grades 3 – 8 were matched, and 55% were included in the analysis. The 45% not in the analysis were excluded primarily for not meeting the first criteria. From the table below, one can see that the lowest percentage of students in the analysis, by grade, occurs in grades 5 to 6 and 6 to 7, which are the most common school breaks.

**Table 1. Student Match Rate by Grade (1998 to 1999)**

Grade 1998	Grade 1999	Students Eligible 1998-1999	Match Rate 1998-1999	Percent of Eligible Students in 1998- 1999 Analysis
3	4	59666	88%	62%
4	5	59519	90%	65%
5	6	59502	89%	45%
6	7	60262	89%	36%
7	8	59414	89%	69%
<b>Total</b>		298363	89%	55%

### **Measuring School Growth**

For each school, grade and subject area, the mean scale score of all students in 1998 (SS98) and 1999 (SS99) was computed. Simple Growth for each school, grade level and subject area was calculated by subtracting the mean scale score in 1998 from the mean scale score in

1999. For example, the Simple Growth for School A from grade 3 in 1998 to grade 4 in 1999 in mathematics is calculated as follows:

$$SimpleGrowth_{am3,4} = \overline{SS99_{am4}} - \overline{SS98_{am3}}$$

In order to account for regression to the mean, and thereby take into consideration the school's placement in 1998, the following adjustment was made to the Simple Growth exhibited by each school:

The 1998 mean scale score for every school, grade level and subject area is standardized and transformed into z-scores. In School A's case,

$$Z_{SS98_{am3}} = (\overline{SS98_{am3}} - \overline{distmean_{m3}}) / \overline{diststdv_{m3}}$$

where

*distmean* = mean of the statewide distribution of 1998 scores for the respective grade and subject area

and

*diststdv* = standard deviation of the statewide distribution of 1998 scores for the respective grade and subject area

An adjusted 98 z-score for every school, grade and subject area is computed by multiplying the respective  $Z_{SS98}$  by the correlation between student scale scores of adjoining grades for the state (see Appendix A for table of *distmean*, *diststdv* and *correlation*). For example, in the case of School A

$$ADZ_{SS98_{am3}} = Z_{SS98_{am3}} \times correlation_{m3,4}$$

An adjusted 98 scale score is computed by transforming the adjusted z-scores back into scale scores. In our example,

$$ADSS98_{am3} = (ADZ_{SS98_{am3}} \times \overline{diststdv_{m3}}) + \overline{distmean_{m3}}$$

The Adjusted Growth is then computed by subtracting the adjusted 98 scale score from the 1999 scale score. For School A,

$$AdjustedGrowth_{am3,4} = \overline{SS99_{am4}} - ADSS98_{am3}$$

Below is an example of the regression effects adjustment for three schools that start out at three different absolute achievement levels in 1998. The following is taken from actual data in Reading Grade 4 to 5.

**Table 2. Example of Regression Effects Adjustment at Three Key Percentile Ranks**

	SS98	1998 July Stanford 9 Percentile Rank	Simple Growth	Adjusted Growth	Adjustment Made
School A	607	20	15.28	12.89	-2.39
School B	640	50	15.29	15.14	-0.15
School C	677	80	16.46	18.76	2.30

All three schools have Simple Growth within 1.2 scale score points of each other. School A, due to its relatively low placement on the scale is expected to make gains, simply due to regression to the mean. After the adjustment, School A loses (–) 2.39 scale score points from its Simple Growth. School B’s adjustment is minimal because it is closer to the mean. School C is already quite high on the scale and is expected to score lower in year two due to regression to the mean. After the adjustment, School C is given credit for 2.3 more scale score points than Simple Growth. The *One Year Growth* and *Star Rating* indicators are based on Adjusted Growth.

### **Growth’s Relationship to Prior Achievement**

One concern paramount in the analysis is to ensure that schools are not biased based on their 1998 achievement level. The following tables show the correlation between prior achievement (mean scale score in 1998) and future achievement (mean scale score in 1999), between prior achievement and growth before the regression effects adjustment (Simple

Growth) and between prior achievement and growth after the regression effects adjustment (Adjusted Growth).

**Table 3. Correlation between Prior Achievement and Growth, Mathematics**

Grade	SS98 to SS99	SS98 to Simple Growth	SS98 to Adjusted Growth
3 to 4	0.883	-0.387	-0.088
4 to 5	0.900	-0.28	-0.038
5 to 6	0.916	-0.103	0.129
6 to 7	0.932	-0.208	0.043
7 to 8	0.951	-0.192	0.005

**Table 4. Correlation between Prior Achievement and Growth, Reading**

Grade	SS98 to SS99	SS98 to Simple Growth	SS98 to Adjusted Growth
3 to 4	0.941	-0.259	-0.005
4 to 5	0.962	-0.538	-0.340
5 to 6	0.935	-0.493	-0.279
6 to 7	0.963	0.158	0.331
7 to 8	0.966	-0.558	-0.364

The ability to predict 1999 Scale Scores based on the 1998 Scale Scores is great—almost a one-to-one relationship. The correlation between Simple Growth and prior achievement is relatively low, meaning that Simple Growth cannot be predicted reliably based on prior achievement level—(i.e., neither high nor low achieving schools, as a whole, achieve greater growth). With two exceptions (Mathematics grade 5 to 6 and Reading grade 6 to 7), the correlation between the Adjusted Growth and prior achievement is less than the correlation between Simple Growth and prior achievement.

## **MAP Indicators**

The unit of analysis for the MAP is the grade level within a school. A school/grade level combination is excluded from the analysis and reporting if any of the following statements is true:

1. Less than 8 students, per grade level, are matched between Spring 1998 and Spring 1999.
2. Less than 25% of eligible students in a grade level in Spring 1998 are matched in Spring 1999.
3. The grade level does not have scores on record for both years.
4. The school does not contain at least two adjoining grade levels that are 3-8.

**A note about charter schools:** Charter schools are part of the MAP analysis and are excluded only if they do not meet the above criteria. Many charter schools and a few small rural schools did not meet the criteria and are not included in the MAP analysis.

## **One Year of Growth (OYG)**

*OYG* indicates whether a grade level achieved one year of academic growth, based on Adjusted Growth, from Spring 1998 to Spring 1999. The standard of *OYG* is based on the amount of growth in scale score points that is necessary to remain at the 50<sup>th</sup> percentile from one grade to the next higher grade. Although the amount of growth expected at various percentile ranks is different, the amount of growth expected on average across grades 3 – 8 at key percentile points is a maximum of 1 scale score point in Mathematics and 1.4 scale score points in Reading from the expected growth in scale score points at the 50<sup>th</sup> percentile.

The expected growth at the 50<sup>th</sup> percentile is also used as the standard for measuring *OYG* because it is the most accurate point of the test. The amount of error inherent in the test increases as scores deviate from the 50<sup>th</sup> percentile.



The following two tables represent the scale scores at key percentile points and the expected gain (EG) to remain at each key percentile point from one grade to the next. The MAP analysis uses the EG at the 50<sup>th</sup> percentile (P50) to determine *OYG*.

**Table 5. SAT 9 Scaled Scores at Key Percentile Points – Total Mathematics**

	GRADE											
PR	3	EG	4	EG	5	EG	6	EG	7	EG	8	AVG EG
P90	653	23	676	15	691	20	711	10	721	10	731	15.6
P75	625	25	650	21	671	11	682	14	696	11	707	16.4
P50	<b>599</b>	<b>26</b>	<b>625</b>	<b>21</b>	<b>646</b>	<b>10</b>	<b>656</b>	<b>14</b>	<b>670</b>	<b>10</b>	<b>680</b>	<b>16</b>
P25	572	27	599	25	624	7	631	17	648	9	657	17
P10	549	27	576	25	601	8	609	18	627	7	634	17

**Table 6. SAT 9 Scaled Scores at Key Percentile Points – Total Reading**

	GRADE											
PR	3	EG	4	EG	5	EG	6	EG	7	EG	8	AVG EG
P90	675	15	690	14	704	7	711	15	726	17	743	13.6
P75	646	21	667	12	679	8	687	18	705	11	716	14
P50	<b>616</b>	<b>21</b>	<b>637</b>	<b>18</b>	<b>655</b>	<b>8</b>	<b>663</b>	<b>18</b>	<b>681</b>	<b>10</b>	<b>691</b>	<b>15</b>
P25	586	23	609	19	628	9	637	16	653	12	665	15.8
P10	559	24	583	19	602	12	614	13	627	12	639	16

- A *Yes* is indicated for the *OYG* indicator on the School/Grade Level Report if the grade level either met or exceeded the standard.
- A *No* is indicated for the *OYG* indicator on the School/Grade Level Report if the grade level did not meet the standard.

### **Star Rating**

In order to look at the differences in growth among schools, particularly schools with similar prior achievement, a system of categorizing schools according to the amount of Adjusted

Growth made was developed. The *Star Rating* indicates the Adjusted Growth, by grade level, of a school in relation to the Adjusted Growth of other schools in the state. The *Star Rating* ranges from 1 (Low) to 5 (Excellent). For each grade level in a school, the *Star Rating* is interpreted as follows:

**5** (Excellent) – the grade level performed better than 80% of Arizona schools in academic growth.

**4** (Above Average) – the grade level performed better than 60% of Arizona schools in academic growth.

**3** (Average) – the grade level performed better than 40% of Arizona schools in academic growth.

**2** (Below Average) – the grade level performed better than 20% of Arizona schools in academic growth.

**1** (Low) - the grade level is among the bottom 20% of Arizona school in academic growth

The *One Year of Growth* indicator and the *Star Rating* are not dependent upon each other. For example, a grade level in School A can have a *Star Rating* of 2 (Below Average) and still achieve *One Year of Growth*. This case is possible if schools across the entire state scored exceptionally well and, by comparison to all schools throughout the state, the amount of growth made by the grade level in School A was below average but still above the standard needed to achieve *One Year of Growth*.

Following are two tables containing the range, mean and standard deviation of Adjusted Growth by grade and *Star Rating* category.

**Table 7. Range, Mean and Standard Deviation of Adjusted Growth  
By Grade and Star Rating, Mathematics**

Grade 1998 to Grade 1999	Star Rating	N	Minimum	Maximum	Mean	Std. Deviation
3 to 4	1	134	-21.0100	25.0600	19.8137	6.3147
	2	135	25.1800	31.0100	28.0729	1.7713
	3	134	31.0500	34.7800	32.8391	1.0868
	4	135	34.8100	40.5400	37.5854	1.6266
	5	134	40.5700	73.7600	45.8051	5.0496
4 to 5	1	138	-4.8400	17.7600	13.0210	4.0879
	2	138	17.8700	22.4400	20.3289	1.2931
	3	138	22.4400	26.6700	24.6292	1.2471
	4	138	26.7700	31.4100	29.0088	1.2750
	5	138	31.4800	60.6800	36.9831	5.3850
5 to 6	1	93	-6.5200	14.8400	9.8237	3.9881
	2	93	14.9300	19.7100	17.1652	1.3422
	3	93	19.7600	23.6500	21.8445	1.0939
	4	93	23.6800	27.4300	25.6561	1.1571
	5	93	27.5100	63.6800	33.0201	5.8368
6 to 7	1	52	-14.5700	8.8400	4.7898	3.9117
	2	53	8.8600	11.6700	10.4408	0.8369
	3	53	11.7000	15.4900	13.3311	1.1577
	4	53	15.5100	19.2500	17.4217	1.1841
	5	52	19.4500	47.2000	25.2263	5.6888
7 to 8	1	68	-11.0690	6.4373	3.2154	3.0815
	2	68	6.5035	8.6418	7.5749	0.5705
	3	69	8.6468	10.7733	9.6947	0.6234
	4	68	10.8681	14.5093	12.4855	1.0288
	5	68	14.5290	38.2723	19.1643	4.7340

**Table 8. Range, Mean and Standard Deviation of Adjusted Growth  
By Grade and Star Rating, Reading**

Grade 1998 to Grade 1999	Star Rating	N	Minimum	Maximum	Mean	Std. Deviation
3 to 4	1	133	-7.4670	23.9270	18.5823	5.1405
	2	134	23.9339	27.6830	25.8397	1.0641
	3	133	27.6875	30.6977	29.1683	0.9306
	4	134	30.6980	34.1272	32.2759	1.0271
	5	133	34.1772	59.2448	38.4847	4.4176
4 to 5	1	137	-8.1407	10.3920	7.4191	2.9881
	2	137	10.4131	13.6596	12.1995	0.9819
	3	138	13.6940	16.0185	14.8513	0.6448
	4	137	16.0621	19.3142	17.6341	0.8497
	5	137	19.3852	35.6607	22.7496	3.3757
5 to 6	1	92	-31.2573	8.8954	4.9052	5.1846
	2	93	8.9076	11.1717	10.0815	0.7112
	3	92	11.1728	13.6299	12.3977	0.7187
	4	93	13.6858	16.4253	14.9492	0.7480
	5	92	16.4467	49.6712	20.3100	4.9417
6 to 7	1	52	-5.0527	14.0786	10.3923	4.0223
	2	53	14.2250	17.2039	15.7578	0.8561
	3	53	17.2720	20.1446	18.5819	0.9238
	4	53	20.1478	23.1142	21.6104	0.8664
	5	52	23.2060	35.7411	25.8365	2.4197
7 to 8	1	68	-5.8934	10.2627	7.6889	2.9105
	2	68	10.2889	12.3719	11.3502	0.5753
	3	68	12.3923	14.3563	13.3443	0.5575
	4	68	14.3623	17.1721	15.5334	0.8502
	5	68	17.2172	31.2545	20.6572	2.9774

## Appendix A

### Mathematics

#### Mean and Standard Deviation of Statewide 1998 Scale Scores

Grade 1998 to Grade 1999	N	<i>distmean</i>	<i>diststdv</i>
3 to 4	759	597.4	23.33
4 to 5	757	627.5	21.59
5 to 6	549	648.8	22.5
6 to 7	332	661.6	21.6
7 to 8	413	674.6	22.47

### Reading

#### Mean and Standard Deviation of Statewide 1998 Scale Scores

Grade 1998 to Grade 1999	N	<i>distmean</i>	<i>diststdv</i>
3 to 4	757	615.5	23.63
4 to 5	757	642.8	22.90
5 to 6	548	656.3	21.53
6 to 7	333	663.2	19.89
7 to 8	412	681.1	22.03

#### Correlation Between Scale Scores of Adjoining Grades for the State

Grade 1998 to Grade 1999	Math	Reading
3 to 4	0.86	0.91
4 to 5	0.89	0.93
5 to 6	0.90	0.91
6 to 7	0.91	0.94
7 to 8	0.94	0.94